SMALL ANIMAL TELEMETRY - AN OVERVIEW

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The techniques of telemetering information from small animals is, in principle, no different from that involving large animals. In practice, however, the limits imposed by size and weight can be severe. It may be idle gossip to state that whatever one can do in a small animal can be done in a large one, but the impracticality of always achieving the reverse is gospel. Small animals come in all sizes and shapes so that generalizations are difficult to make. There are small animals like dogs and rabbits and smaller ones like mice, bats, lizards, grasshoppers and flys, and each may be a likely candidate for telemetry. Although options are fewer as size gets smaller, it is inventive imagination which has the last say in this matter.

There are many ways to think small, and microelectronics is one of them. Modern integrated circuit technology seems to have no limit in its ability to reduce circuitry to a mere fraction of its former self and would appear ideal for this purpose. It is, nonetheless, an expensive technique and for practical purposes out of reach of the lone researcher on a restricted budget who requires only a small number of devices. Miniature discrete components and a deft soldering iron can often achieve the same end at a much more reasonable cost. Circuit reduction alone, however, is not the only problem, and efforts in this direction are easily dwarfed by other factors, such as bulky power sources, massive packaging techniques and gigantic transducers.

Power sources have long been an area of concern in telemetry. Transmission life and distance can be measured in power, and when the requirements are high, so is the bulk. Pulsed and passive circuits, rechargeable batteries and biological power sources have been the answer to some problems, but certainly not all. New types of circuitry await development which will reduce to a minimum the necessary size contribution of this component.

Packaging techniques for implant devices are in an archaic state. Synthetic resins, waxes and other concoctions in common use are of questionable reliability, and transmitter failure due to insufficient protection from body fluids is something all users of implanted devices experience to one degree or another. Increased thickness may provide greater protection, but the gamble is costly when size is critical. Characterization, standardization and documentation of these materials is practically nonexistent in the literature, and their use is based almost entirely on speculative hearsay. It is better to know that a given material is unfit for a job than to have its failure jeopardize other efforts. Certainly glasses, metals and ceramics are not receiving the attention they deserve in this regard.

In appraising the problems of small animal telemetry it is difficult to ignore the lack of miniaturized transducers. Beyond the relatively easy-to-monitor parameters of temperature and bioelectric phenomena, there is little available for transducing flow, pressure, gas tensions, ion concentrations, and the like which meet the size requirement for small animal applications. Attempts to reduce standard transducers to a useable size are not always successful, nor even desirable with respect to long term stability requirements. The best answer appears to lie with imaginative engineering and the development of new methods of transduction.

One important consideration remaining to be discussed is the cost of small animal telemetry. All too often biologists underestimate the expense in time and money of using this technique. Realistic appraisals are hard to come by and are seldom believed when given. The unique nature of most applications means high development costs which, when coupled to the expense of data handling and reduction equipment, can represent a sizeable tab. J. P. Morgan’s admonition that “any man who has to ask about the annual upkeep of a yacht cannot afford one” is reasonable advice to the telemetry shopping biologist as well.